Investigation of the Magnetic Disturbance by the Induction Magnetograph.

INVESTIGATION OF THE MAGNETIC DISTURBANCE BY THE INDUCTION MAGNETOGRAPH

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The author observed the three components of dH/dt of the earth's magnetic field constantly by the induction magnetograph at Onagawa ($\lambda=141°28'$E, $\varphi=38°26'$N) near Sendai from 1947. Especially at the time of the expedition of the solar eclipse of Sept. 12,1950, the author observed dH/dt at Katsuura ($\lambda=135°57'$E, $\varphi=33°58'$N) and Nemuro, Hokkaidô ($\lambda=145°35.5'$E, $\varphi=43°19.5'$) simultaneously adding at above Onagawa magnetic observatory.

The instrument is constructed by the induction coil which is wound around the high permeability metal and galvanometer. The constant is as follows:

Permeability of Sendust-bar	$\mu=ca.$ 900 e.m.u.
Turns of coil	$N=ca.$ 6200
Resistance of coil	$R=ca.$ 30 Ω
Self-induction	$L=ca.$ 28 H

The error of amplitude and time lag caused by the inductance of the coil is not larger than 10% in the former and is smaller than 20° in the phase difference.

The results obtained are as follows:

At the time of sudden commencement of the first phase of magnetic strom, the oscillation of dH/dt is rather large, next in the interval till entering to the second phase the variation is small and against the initial part of the main phase the period of the oscillation becomes very short and large amplitude continues distinctly.

Namely it can be said that in the first phase and the second phase of the magnetic storm, two kinds of radiant ray of different properties and different velocities reached the upper atmosphere. And it is preferable to consider the first phase to be due to what has extremely rapid velocity and in the previous paper the author considered that this may be the extreme ultraviolet ray, and the main phase to be due to the particle emitted from the sun.

The type of the change of dH/dt at the sudden commencement varies respectively, according as it occurs in the night hemisphere or day hemisphere, that is the oscillation of dH/dt is very remarkable at daytime, while it is very weak at night. In the day hemisphere the amplitude of the oscillation of dH/dt is greater than that which occur in the night hemisphere, as showin in Fig. 1. Fig. 1 are the records of dH/dt of the sudden commencement of the magnetic strom in the period of the recent two years (1948 and 1949).

Next, the time of the occurrence of the sndden commencement of the magnetic strom of Sept. 16,1950 is somewhat earlier at Katsuura than at Nemuro as shown in Table 1, and the oscillation of short period superposed distinctly in the record at Nemuro, as illustrated in Fig. 2.

At the time of the bay-disturbance, dH/dt is changed only at the initial part and soon reduced to calm at the time when the phase of

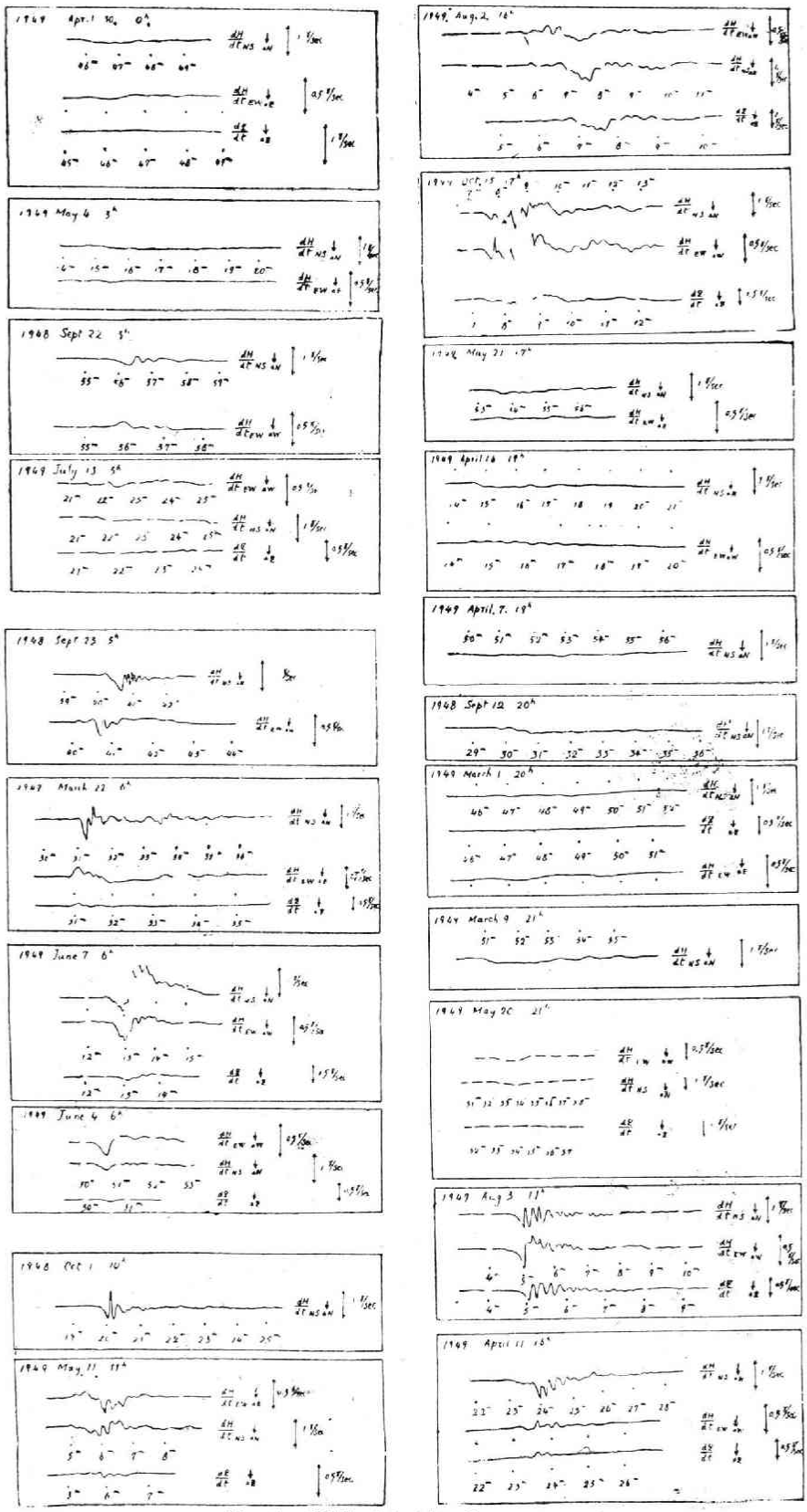


Fig. 1. dH/dt of Sudden Commencement.

Table 1.

Time of Occurrence of Sudden Commencement (J. S. T)				
Nemuro	$\lambda=145°35.'3$	$\varphi=43°19.'5$	19^h17^m	$15.^s0\pm0.^s3$
Onagawa	$\lambda=141°28'$	$\varphi=38°26'$	〃 〃	14.5 ±0.5
Katsuura	$\lambda=135°57'$	$\varphi=33°58'$	〃 〃	14.1 ±0.3

the horizontal component reaches to its maximum amplitude as shown in Fig. 3. The time of occurrence is earlier at Nemuro than at Katsuura at the time of bay-disturbance of Sept. 1, 1950.

Table 2.

Time of Occurrence of Bay-Disturbance			
Nemuro	Sept. 19	20^h16^m	$47.^s9$
Katsuura		. . .	50. 3

The author considered that the oscillation of dH/dt which experienced only at the initial part of bay-disturbance is caused by the small fluctuation of the conductivity in the current system in the ionosphere of auroral zone at the initial time due to the penetration of the charged particle. Fig. 4 shows the current system of the bay-disturbance calculated by E. H. VESTINE[1].

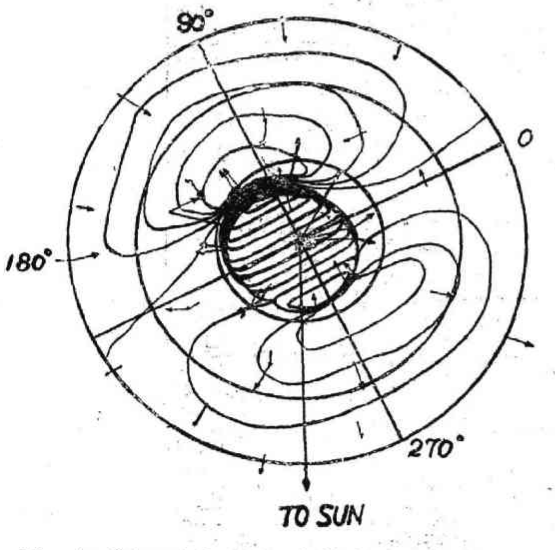


Fig. 4. Current System of the Bay-Disturbance (E. H. VESTINE)

The current system at the time of the initial phase of the magnetic storm of Oct. 14, 1932 was also calculated by E. H. VESTINE (Fig. 5).

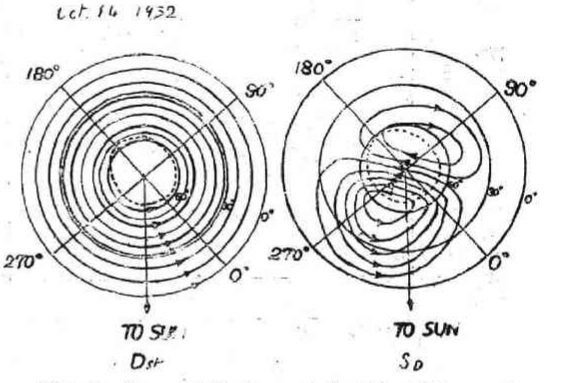


Fig. 5. Current-System of the First Phase of Magnetic Storm (E. H. VESTINE)

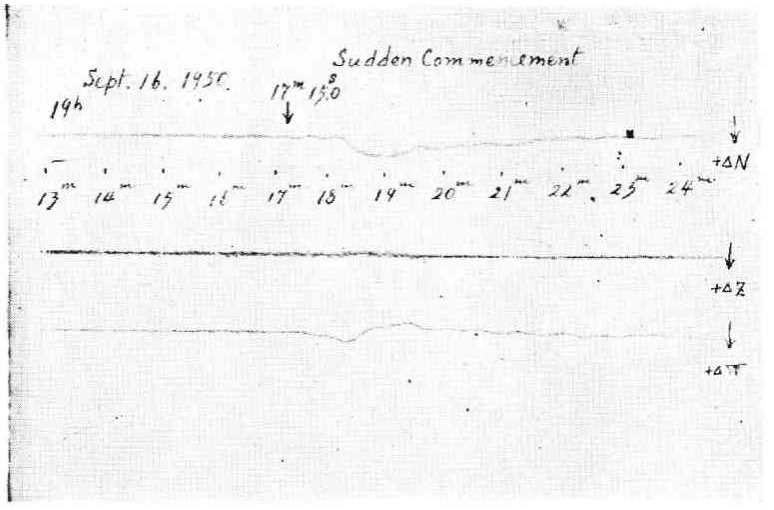
The author considered that the oscillation of dH/dt of sudden commencement which frequently occured at day time is due to the fluctuation of conductivity of S_D which is remarkable in the day hemisphere as illusrated by E. H. VESTINE, and the gradual part in dH/dt of the sudden commencement is due to the symmetrical part which is called D_{st} by E. H. VESTINE.

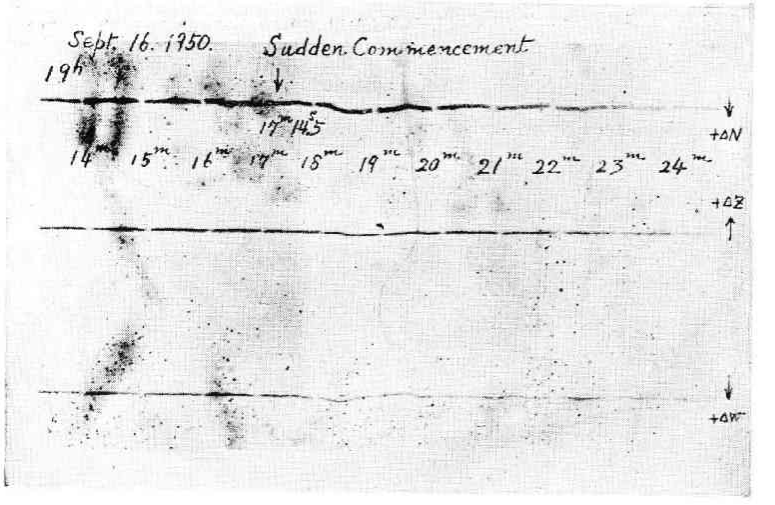
Above stated character is favorable to author's theory which published recently[2].

The author wishes to thank Ministry of Education whose financial support made these researches possible.

1) E.H. VESTINE, Lucile LAPORTE, Isabelle LANGE, W. E. SCOTT: The Geomagnetic Field, Its Description and Analysis. *Carnegie Institution of Washington Publication*, 1947.

2) Y. KATO: On a New Theory of the Magnetic Storm. *Science Reports of the Tohoku University, Series. 5*, Vol. 1, No. 1, 1949.





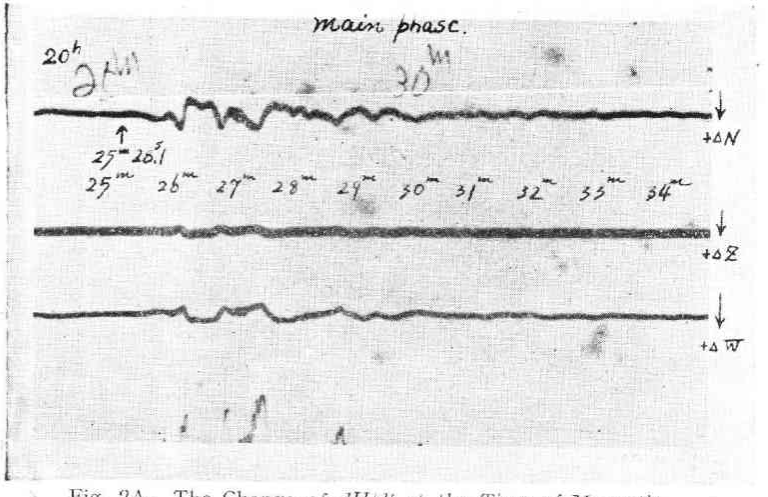


Fig. 2A, The Change of dH/dt at the Time of Magnetic Storm Sept. 16, 1950 at Nemuro, Hokkaido.

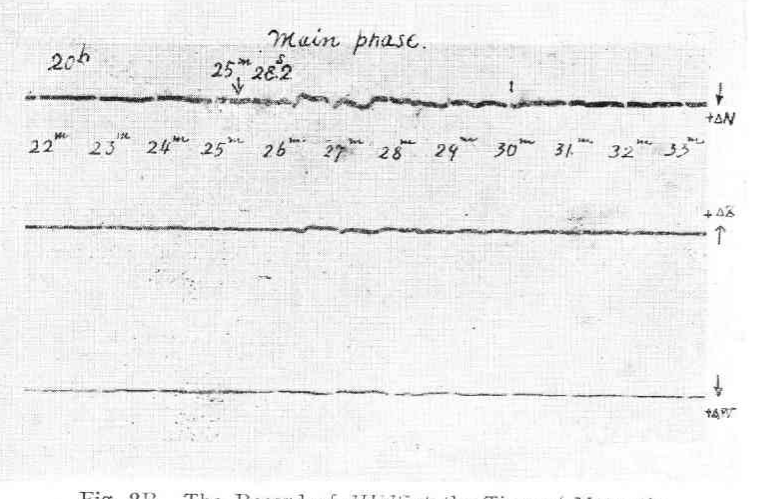
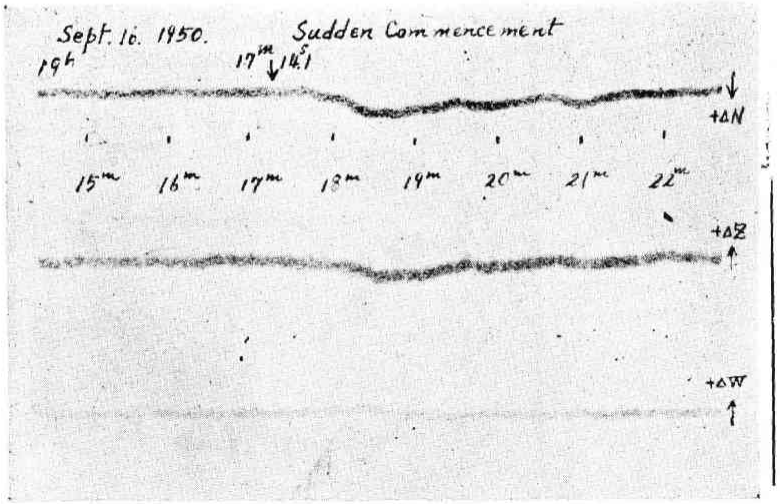


Fig. 2B, The Record of dH/dt at the Time of Magnetic Storm Sept. 16, 1950 at Onagawa.



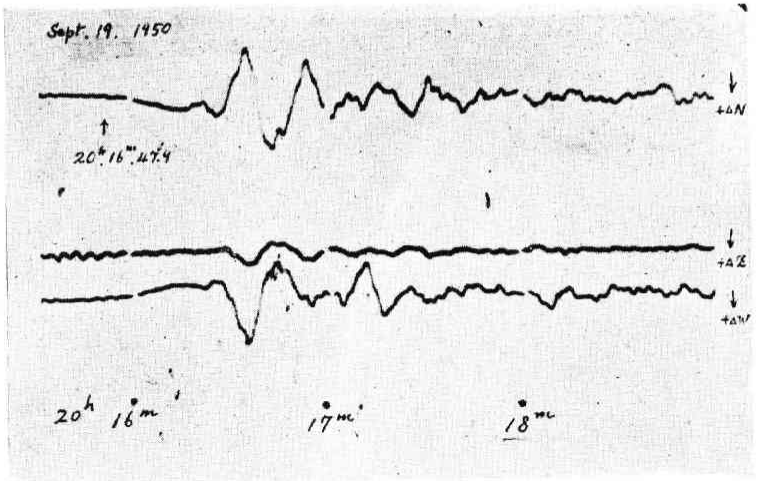


Fig. 3A, The Change of dH/dt at the Time of Bay-Disturbance at Nemuro.

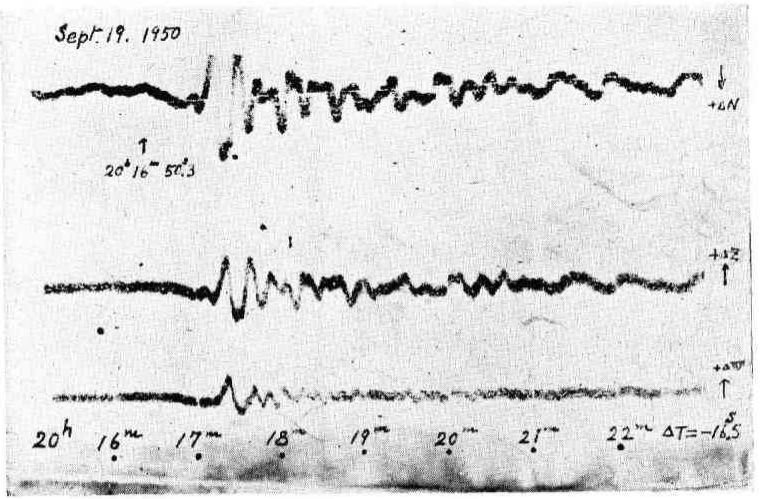


Fig. 2C, The Record of dH/dt at the Time of Magnetic Storm Sept. 16, 1950 at Katsuura.

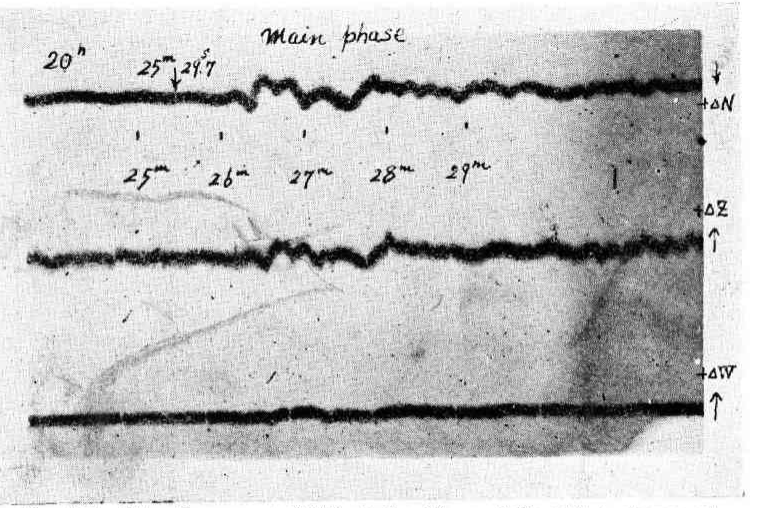


Fig. 3B, The Change of dH/dt at the Time of Bay-Disturbance at Katsuura.